



[4910-13-P]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA-2016-9072; Product Identifier 2015-NM-110-AD; Amendment 39-19797; AD 2019-23-04]

RIN 2120-AA64

Airworthiness Directives; The Boeing Company Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The FAA is adopting a new airworthiness directive (AD) for certain The Boeing Company Model 727 airplanes. This AD was prompted by the FAA's analysis of the Model 727 fuel system review conducted by the manufacturer. This AD requires modifying the fuel quantity indicating system (FQIS) to prevent development of an ignition source inside the body-mounted auxiliary fuel tanks due to electrical fault conditions. As an alternative to the modification, this AD allows deactivating the body-mounted auxiliary fuel tanks. The FAA is issuing this AD to address the unsafe condition on these products.

DATES: This AD is effective [INSERT DATE 35 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES:

Examining the AD Docket

You may examine the AD docket on the Internet at <https://www.regulations.gov> by searching for and locating Docket No. FAA-2016-9072; or in person at Docket Operations between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this final rule, the regulatory evaluation, any comments

received, and other information. The address for Docket Operations is U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue SE., Washington, DC 20590.

FOR FURTHER INFORMATION CONTACT: Jon Regimbal, Aerospace Engineer, Propulsion Section, FAA, Seattle ACO Branch, 2200 South 216th St., Des Moines, WA 98198; phone and fax: 206-231-3557; email: Jon.Regimbal@faa.gov.

SUPPLEMENTARY INFORMATION:

Background

The FAA issued a notice of proposed rulemaking (NPRM) to amend 14 CFR part 39 by adding an AD that would apply to certain Boeing Model 727 airplanes equipped with Boeing body-mounted auxiliary fuel tanks. The NPRM published in the Federal Register on September 23, 2016 (81 FR 65579). The NPRM was prompted by the FAA's analysis of the Model 727 fuel system review conducted by the manufacturer. The NPRM proposed to require modifying the FQIS to prevent development of an ignition source inside the body-mounted auxiliary fuel tanks due to electrical fault conditions. As an alternative to the modification, the NPRM proposed to allow deactivating the body-mounted auxiliary fuel tanks.

The FAA is issuing this AD to address ignition sources inside the body-mounted auxiliary fuel tanks, which, in combination with flammable fuel vapors, could result in a fuel tank explosion and consequent loss of the airplane.

Comments

The FAA gave the public the opportunity to participate in developing this final rule. The following presents the comments received on the NPRM and the FAA's response.

Request to Withdraw NPRM: No Unsafe Condition

Boeing requested that the FAA withdraw the NPRM. Boeing reported that its system safety assessment determined that the FQIS on the Model 727 airplane does not have an unsafe condition.

The FAA disagrees with the request. Boeing did not provide specific details about the type of assessment that was performed (total fleet risk, average risk per flight hour, peak individual flight risk, etc.). Based on Boeing's fuel system safety assessment submitted in response to Special Federal Aviation Regulation No. 88 ("SFAR 88") of 14 CFR part 21, the FAA has determined that there is an unsafe condition due to the potential for a fuel tank ignition source to occur from the FQIS due to its design architecture, component design details, and installation design details. The FAA's determination was made in accordance with the guidance contained in FAA Policy Memorandum ANM100-2003-112-15, "SFAR 88-Mandatory Action Decision Criteria," dated February 25, 2003.¹ Under that policy, an ignition source that can occur in a high-flammability fuel tank, due to a combination of a preexisting failure that can exist undetected for multiple flights and one additional failure, is an unsafe condition requiring corrective action. High-flammability fuel tanks are defined in the policy as fuel tanks with a fleet average flammability greater than 7 percent as calculated in accordance with 14 CFR Appendix N of part 25. At the time of the unsafe condition determination in April 2003, Boeing acknowledged that the Model 727 body-mounted auxiliary fuel tanks are high-flammability fuel tanks. The Boeing SFAR 88 report for the Model 727 showed that a combination of an in-tank wire fault or contamination condition (which can remain latent for multiple flights) and a hot short outside of the tank between the affected FQIS tank circuit and other aircraft power wiring cobundled with FQIS tank circuit wiring

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[http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgPolicy.nsf/0/dc94c3a46396950386256d5e006aed11/\\$FILE/Feb2503.pdf](http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgPolicy.nsf/0/dc94c3a46396950386256d5e006aed11/$FILE/Feb2503.pdf)

could result in an ignition source in the fuel tank. That combination of failures was classified by the FAA as a “known combination of failures” under the criteria in the policy memo due to the similarity of the Model 727 FQIS system architecture and design details to those of the Boeing Model 747 airplane involved in the TWA Flight 800 catastrophic fuel tank explosion accident in 1996. The National Transportation Safety Board (NTSB) concluded that an FQIS failure combination as described above was the most likely cause of that accident.² The FAA has therefore determined that it is necessary to issue this final rule.

Request to Withdraw NPRM: Limited Vulnerability to Unsafe Condition

Boeing requested that the FAA withdraw the NPRM. Boeing stated that 272 airplanes were manufactured with body-mounted auxiliary fuel tanks, but only six were operated under FAA jurisdiction when the comment was submitted, and that the fleet exposure continues to decrease due to airplane aging and retirements. Boeing stated that its safety assessment, using methodologies “recognized by the FAA,” shows that the vulnerability of the Model 727 FQIS latent failure plus single failure does not present an unsafe condition. Boeing concluded that requiring the proposed actions will not promote air safety and instead will add unnecessary cost to operators.

The FAA disagrees with the request. The FAA has determined that an unsafe condition exists. The FAA assumes that, in citing assessment methodologies recognized by the FAA, Boeing is referring to having performed its assessment of the total fleet risk for the Model 727 fleet that showed a very low likelihood of a fuel tank ignition event in the remaining life of that fleet. Boeing mentioned the number of airplanes operated under U.S. jurisdiction. The FAA, as the civil aviation authority of the state of design, is obligated, under the Convention on International Civil Aviation (the Treaty), to inform all

² NTSB Aviation Accident Report AAR-00-03
<https://www.nts.gov/investigations/AccidentReports/Reports/AAR0003.pdf>.

affected aircraft of continuing safety issues regardless of where they are operated.

Issuance of airworthiness directives is the accepted method by which the FAA notifies aviation authorities of other countries of an unsafe condition as required by Annex 8 of the Treaty.

The FAA's unsafe condition determination was made using the decision criteria in FAA Policy Memorandum ANM100-2003-112-15. This determination was not driven by a fleet risk assessment. A latent in-tank failure that provides a conductive path or reduces dielectric strength of the tank wiring or components, combined with an external wiring system failure that conducts power onto the tank wiring, could create an ignition source in the fuel tank of the Boeing Model 727 airplane. That combination of failures was classified as a "known combination of failures" under the criteria in the policy memorandum due to the similarity of the Model 727 FQIS system architecture and design details to those of the Model 747 airplane involved in the catastrophic fuel tank explosion. The NTSB concluded that an FQIS failure combination as described above was the most likely cause of that accident. The FAA therefore considers it necessary to address this unsafe condition. The per-airplane cost for modification is expected to be approximately the same as the cost of the similar actions required for Model 737 and 747 airplanes specified in AD 99-03-04, Amendment 39-11018 (64 FR 4959, February 2, 1999) ("AD 99-03-04"); and AD 98-20-40, Amendment 39-10808 (63 FR 52147, September 30, 1998) ("AD 98-20-40"). If an operator chooses to deactivate or remove the auxiliary tanks as allowed by the AD, the cost would be significantly lower. Therefore, the FAA made no changes in this final rule as a result of this comment.

Request to Withdraw NPRM: Extremely Remote Likelihood of Unsafe Condition

Boeing requested that the FAA withdraw the NPRM. Boeing considered the likelihood of an undetected latent electrical fault condition of the FQIS to be extremely remote, due to the FQIS architecture. Boeing added that the existing Model 727 FQIS

design uses a three-wire system that goes directly from the fuel tank to the flight deck indication. Boeing stated that an electrical fault of an in-tank component causes the FQIS to provide a fault indication to the flight crew, so the failure is not latent.

The FAA disagrees with the request. The agency contacted Boeing to resolve the apparent conflict between this comment and the company's previously submitted SFAR 88 reports. In the SFAR 88 reports for Model 727 airplanes, Boeing stated that a latent in-tank failure condition could not be claimed to be extremely remote, and acknowledged that the system does not comply with the requirements of 14 CFR 25.981(a)(3) related to a latent failure plus a single failure. (Extremely remote qualitatively means that the condition would occur no more than a few times in the total fleet life. In numerical probability analysis, a condition that has a probability on the order of 1 in 10 million flight hours or less is considered extremely remote.) However, the comment that Boeing submitted to the NPRM stated that a latent in-tank failure was extremely remote.

A meeting with representatives from the FAA and Boeing was held February 15, 2019, to clarify Boeing's position. (A record of that meeting has been posted to the AD docket.) Boeing explained that it had intended to convey in its comment that the estimated probability for the initial failure that creates a latent in-tank loss of dielectric strength, resistive current path, or short condition is extremely remote. Boeing acknowledged that when the estimated probability of that failure initiation is multiplied by the average latency period, the probability of a latent in-tank failure existing in any given flight hour is not extremely remote.

Given this clarification, Boeing's comment was consistent with the conclusions of its SFAR 88 reviews. The FQIS does not provide a fault indication to the flight crew other than unusual readings or a zero reading provided by a tank gage if a hard short to ground or power occurs. In addition, even if such a fault is noted by the flight crew, the approved Master Minimum Equipment List for the Model 727 airplane allows operators

to fly for up to ten days in that condition, without disconnecting the FQIS for the affected tank, with provisions for extending beyond the ten days. The FAA therefore does not agree that a latent failure of in-tank wiring or components, such that an ignition source could occur if an external hot short occurs, is extremely remote. No changes were made to this final rule as a result of this comment.

Request to Extend Compliance Time

Boeing requested that the FAA revise the proposed 12-month compliance time, which it asserts will require Model 727 operators to “develop the solution on their own (under 14 CFR part 121).” Boeing stated that it had no plans to create service action to modify the FQIS or deactivate the auxiliary tank(s), as no operators have contacted Boeing requesting this support.

The FAA disagrees with the request. Boeing did not propose a specific compliance time, and after consideration, the agency still considers 12 months to be adequate to allow operators to deactivate their auxiliary tanks using existing information in the airplane maintenance manual to develop alteration data and obtain FAA approval of an alternative method of compliance (AMOC). A compliance time of 12 months or less is required for the deactivation of other after-market body-mounted auxiliary fuel tanks on Model 727 airplanes in other ADs: AD 2008-07-07, Amendment 39-15448 (73 FR 15880, March 26, 2008); AD 2008-07-09, Amendment 39-15450 (73 FR 16515, March 28, 2008); AD 2008-12-03, Amendment 39-15546 (73 FR 31749, June 4, 2008); and AD 2009-20-01, Amendment 39-16024 (74 FR 48007, September 21, 2009). The FAA has not changed this AD regarding this issue. Under the provisions of paragraph (h) of this AD, however, the FAA will consider requests for approval of an extension to the compliance time if sufficient data are submitted to substantiate that the new compliance time would provide an acceptable level of safety.

Request to Revise Cost Estimate

Boeing requested that if the NPRM is not withdrawn, the FAA revise the cost estimate to reflect the cost of developing an FQIS design solution for the body-mounted auxiliary tanks. Boeing expected that only six airplanes would actually be modified, so the cost of developing a design solution would be spread over a small number of airplanes, resulting in a significant per-airplane cost. Boeing did not provide any specific cost information or describe the modifications for which they provided cost comments.

The FAA disagrees with the request to revise the cost estimate based on this comment. The agency based its cost estimate for Model 727 passenger airplanes on the inflation-adjusted estimated costs for installation of transient suppression devices on the Model 747 airplane as required by AD 98-20-40. The FAA considers that the transient suppression design solutions, if not the actual parts, developed for Model 737 and 747 airplanes in response to AD 99-03-04 and AD 98-20-40 will be applicable to the Model 727 airplane due to the similarity of those models' FQIS designs. The FAA agrees that the nonrecurring design development costs associated with any necessary model-specific design activity will be spread over fewer airplanes, resulting in higher per-airplane costs if the operator decides not to deactivate the subject tanks. However, the FAA increased the cost estimate in the NPRM to reflect that increased cost to the existing fleet. Boeing did not propose any specific alternative cost figures to be substituted for the FAA estimate. The FAA did not change this final rule as a result of this comment.

Conclusion

The FAA reviewed the relevant data as previously discussed, considered the comments received, and determined that air safety and the public interest require adopting this final rule as proposed, except for minor editorial changes. The FAA has determined that these minor changes:

- Are consistent with the intent that was proposed in the NPRM for addressing the unsafe condition; and
- Do not add any additional burden upon the public than was already proposed in the NPRM.

Costs of Compliance

The FAA estimates that this AD affects 6 airplanes of U.S. registry. The FAA estimates the following costs to comply with this AD:

Estimated costs: Required actions

Action	Labor cost	Parts cost	Cost per product	Cost on U.S. operators
Modification	300 work-hours X \$85 per hour = \$25,500	\$100,000	\$125,500	\$753,000

Estimated costs: Alternative actions

Action	Labor cost	Parts cost	Cost per product
Tank deactivation	10 work-hours X \$85 per hour = \$850	\$0	\$850

Authority for this Rulemaking

Title 49 of the United States Code specifies the FAA’s authority to issue rules on aviation safety. Subtitle I, section 106, describes the authority of the FAA Administrator. Subtitle VII: Aviation Programs, describes in more detail the scope of the Agency’s authority.

The FAA is issuing this rulemaking under the authority described in Subtitle VII, Part A, Subpart III, Section 44701: “General requirements.” Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority

because it addresses an unsafe condition that is likely to exist or develop on products identified in this rulemaking action.

This AD is issued in accordance with authority delegated by the Executive Director, Aircraft Certification Service, as authorized by FAA Order 8000.51C. In accordance with that order, issuance of ADs is normally a function of the Compliance and Airworthiness Division, but during this transition period, the Executive Director has delegated the authority to issue ADs applicable to transport category airplanes and associated appliances to the Director of the System Oversight Division.

Regulatory Findings

This AD will not have federalism implications under Executive Order 13132. This AD will not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.

For the reasons discussed above, I certify that this AD:

- (1) Is not a “significant regulatory action” under Executive Order 12866,
- (2) Will not affect intrastate aviation in Alaska, and
- (3) Will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

List of Subjects in 14 CFR Part 39

Air transportation, Aircraft, Aviation safety, Incorporation by reference, Safety.

Adoption of the Amendment

Accordingly, under the authority delegated to me by the Administrator, the FAA amends 14 CFR part 39 as follows:

PART 39 - AIRWORTHINESS DIRECTIVES

- 1. The authority citation for part 39 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

§ 39.13 [Amended]

2. The FAA amends § 39.13 by adding the following new airworthiness directive (AD):

2019-23-04 The Boeing Company: Amendment 39-19797; Docket No. FAA-2016-9072; Product Identifier 2015-NM-110-AD.

(a) Effective Date

This AD is effective [INSERT DATE 35 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

(b) Affected ADs

None.

(c) Applicability

This AD applies to The Boeing Company Model 727, 727-100, 727C, 727-100C, 727-200, and 727-200F series airplanes; certificated in any category; equipped with Boeing body-mounted auxiliary fuel tanks.

(d) Subject

Air Transport Association (ATA) of America Code 28, Fuel.

(e) Unsafe Condition

This AD was prompted by the FAA's analysis of the Model 727 fuel system review conducted by the manufacturer. The FAA is issuing this AD to address ignition sources inside the body-mounted auxiliary fuel tanks, which, in combination with flammable fuel vapors, could result in a fuel tank explosion and consequent loss of the airplane.

(f) Compliance

Comply with this AD within the compliance times specified, unless already done.

(g) Modification

Within 12 months after the effective date of this AD, do the actions specified in either paragraph (g)(1) or (2) of this AD, using a method approved in accordance with the procedures specified in paragraph (h) of this AD.

(1) Modify the fuel quantity indicating system (FQIS) to prevent development of an ignition source inside the body-mounted auxiliary fuel tanks due to electrical fault conditions.

(2) Deactivate the body-mounted auxiliary fuel tanks.

(h) Alternative Methods of Compliance (AMOCs)

(1) The Manager, Seattle ACO Branch, FAA, has the authority to approve AMOCs for this AD, if requested using the procedures found in 14 CFR 39.19. In accordance with 14 CFR 39.19, send your request to your principal inspector or local Flight Standards District Office, as appropriate. If sending information directly to the manager of the certification office, send it to the attention of the person identified in paragraph (i) of this AD. Information may be emailed to: 9-ANM-Seattle-ACO-AMOC-Requests@faa.gov.

(2) Before using any approved AMOC, notify your appropriate principal inspector, or lacking a principal inspector, the manager of the local flight standards district office/certificate holding district office.

(3) An AMOC that provides an acceptable level of safety may be used for any repair, modification, or alteration required by this AD if it is approved by The Boeing Company Organization Designation Authorization (ODA) that has been authorized by the Manager, Seattle ACO Branch, FAA, to make those findings. To be approved, the repair method, modification deviation, or alteration deviation must meet the certification basis of the airplane and the approval must specifically refer to this AD.

(i) Related Information

For more information about this AD, contact Jon Regimbal, Aerospace Engineer, Propulsion Section, FAA, Seattle ACO Branch, 2200 South 216th St., Des Moines, WA 98198; phone and fax: 206-231-3557; email: Jon.Regimbal@faa.gov.

(j) Material Incorporated by Reference

None.

Issued in Des Moines, Washington, on November 27, 2019.

Michael Kaszycki,
Acting Director,
System Oversight Division,
Aircraft Certification Service.

[FR Doc. 2019-27885 Filed: 12/30/2019 8:45 am; Publication Date: 12/31/2019]